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Title: Fundamental Studies on Intermetallic Aluminides

•Research Objectives:

- (i) To investigate the thermodynamic properties of intermetallic aluminides in the Ti-Al-X (X= Nb, Mo, etc.) systems by EMF method using a solid state galvanic cell (ii) To study the stability of various intermetallic phases in different environments such as air, oxygen, and sulfur.

•Approach

A solid state galvanic cell (EMF) setup using CaF_2 as solid electrolyte has been constructed and preliminary experiments have been carried out on the Ti_3Al intermetallic in the temperature range of 500-800 °C. Oxidation experiments were conducted using a Perkin Elmer TGA 7 HT equipment on a Ti_3Al -3%Nb alloy in pure oxygen in the temperature range of 800-1100 °C. Stability of various phases will be analyzed by various characterizing techniques such as XRD, SEM and EDS. Mechanism of oxidation will be schematically illustrated based on the results obtained from the oxidation experimental data and characterization analysis. Thermodynamic modeling of multicomponent systems was carried out by the classical approach using Maclaurin's and Margules equations.

•Broader Impact:

The successful completion of this project will enhance our fundamental understanding of the phase stability in advanced materials under the influence of diverse environments. The mechanism of oxide layer formation will further the growth of user-defined layered materials which will pave way for a new technology of synthesizing newer materials.

•Significant Results:

Results from the EMF studies on Ti_3Al intermetallic phase are encouraging. However, further experiments will reveal useful information. Oxidation data generated from the oxidation experiments in pure oxygen are being analyzed. Characterization of the product phases is being carried out.

•Graphic:

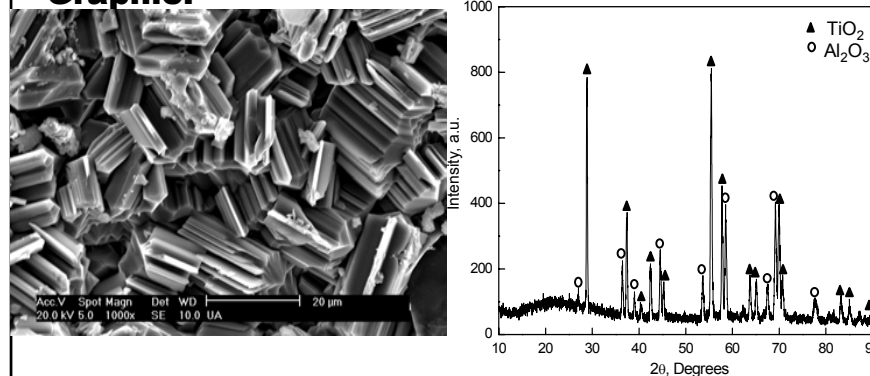


Figure. SEM image and XRD pattern of Ti_3Al alloy oxidized in Ar-5% SO_2 at 1223 K for 20 hours.

List of publications: (four)

1. D. Mantha, X. Wen, R. G. Reddy, *High Temp. Mater. Proc.*, Vol. 23(2), 2004, pp. 93-101.
2. Singareddy R. Reddy, R. G. Reddy, *High Temp. Mater. Proc.*, Vol 23(2), 2004, pp. 133-145.
3. R. G. Reddy and Singareddy R. Reddy, *Z. Metallkunde.*, 2004, (in press).
4. S. R. Reddy and R. G. Reddy, *High Temp. Mater. Proc.*, 2004, (in press).